

## LOW TEMPERATURE.

Omaha, Nebr.: a minimum temperature of  $-13^{\circ}.6$  was registered at 8 a. m. on the 27th, this is  $7^{\circ}.6$  lower than has previously been recorded in November since the establishment of the Signal Service station in 1871.

## MEAN AUTUMNAL TEMPERATURES.

Lead Hill, Boone Co., Ark.: the mean temperature of the autumn of 1887,  $59^{\circ}$ , is  $2^{\circ}$  lower than the normal of the past six years; during that period the warmest autumns,  $62^{\circ}$ , occurred in 1881 and 1884, and the coldest,  $59^{\circ}$ , in 1885.

Palermo, Oswego Co., N. Y.: the mean temperature of autumn of 1887,  $41^{\circ}$ , is  $5^{\circ}$  below the average of the last thirty-four years; the highest autumn mean in that time,  $51^{\circ}$ , occurred in 1855, and the lowest during the present year.

New Ulm, Austin Co., Tex.: the mean temperature of the autumn of 1887,  $68^{\circ}$ , is  $1^{\circ}$  below the average of the last sixteen years.

## FROST.

There were no dates during the month on which frost did not occur; they were most extensively reported on the 1st, 2d, 3d, 18th, 21st, 22d, 29th, 30th; they were least frequent on the 7th, 24th, 25th, and 26th.

Freezing temperatures occurred in all parts of the United States during the month, with the following exceptions: extreme southern Florida; along the immediate Gulf coast from the vicinity of Galveston, Tex., to New Orleans, La., and along the immediate coast of the Pacific, with exception of the Oregon coast.

The Signal Service observer at Titusville, Fla., reports: "a minimum temperature of  $32^{\circ}.5$  occurred on the 21st; ice formed upon exposed places, slightly damaging tender vegetation. The remarkable escape from frost is doubtless attributed

to the smoke and arid condition of the atmosphere and the prevailing fresh breeze, which prevented its formation."

## ICE.

Ice formed in the southern parts of the country as follows: Cedar Springs, S. C., 6th, 20th, 21st; Corsicana, Tex., 11th; Oxford, Miss., 20th; Little Rock, Ark., ice of one-half inch in thickness formed on the 20th; ice also formed on the 21st and 27th; Montgomery, Ala., Cedar Keys, Duke, and Pensacola, Fla., Augusta, and Savannah, Ga., 21st; Archer, Fla., 21st, 22d; Willows, Cal., 23d, 24th; Sacramento, Cal., 25th to 27th; Keeler, Cal., 26th; Willcox, Ariz., and Palestine, Tex., 27th; Corpus Christi and San Antonio, Tex., 28th.

## TEMPERATURE OF WATER.

The following table shows the maximum, minimum, and mean water temperature, as observed at the harbors of the several stations; the monthly range of water temperature; the average depth at which the observations were made, and the mean temperature of the air:

Temperature of water for November, 1887.

Station.	Temperature at bottom.				Mean temperature of air at the station.	Average depth of water in feet and tenths.
	Max.	Min.	Range.	Monthly mean.		
Canby, Fort, Wash.....	53.8	45.1	8.7	49.4	46.5	15.6
Cedar Keys, Fla.....	68.2	54.3	13.9	65.3	62.4	7.3
Charleston, S. C.....	63.3	54.7	8.6	59.0	56.2	36.6
Eastport, Me.....	48.3	45.5	2.8	46.5	37.6	16.0
Galveston, Tex.....	69.8	52.4	17.4	64.4	64.0	14.2
Key West, Fla.....	79.2	71.7	7.5	75.1	73.0	17.2
New London, Conn.....	53.8	45.3	8.5	50.0	42.3	11.9
New York City.....	51.9	43.6	8.3	47.3	43.7	14.8
Pensacola, Fla.....	71.2	60.4	10.8	67.0	60.2	17.3
Portland, Me.....	46.6	41.6	5.0	44.2	37.7	16.5

## PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for November, 1887, as determined from the reports of about eight hundred stations, is exhibited on chart iv. In the table of miscellaneous meteorological data are given, for each Signal Service station, the total precipitation, with the departures from the normal. The figures opposite the names of the geographical districts in columns for mean temperature, precipitation, and departures from the normal, show respectively the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the precipitation is below the normal, and subtracting when above.

The precipitation for November, 1887, as compared with the normal, is deficient in nearly every part of the United States. The deficiency is most marked in the east Gulf states, where the average rainfall for the month is 0.69, or about fifteen per cent. of the normal. In the south Atlantic states about thirty-five per cent. of the normal amount of rain fell. In other districts east of the Mississippi River the deficiencies have been somewhat less marked, but upon the whole only about sixty per cent. of the normal amount of rain fell at signal stations east of the river named. Between the Mississippi and Rocky Mountains the percentage of deficiency is slightly less than in the districts east of the Mississippi—amounting to about seventy-five per cent.—there being a slight excess over the average in the Rio Grande Valley and southern slope. In the middle Pacific coast region the rainfall amounted to about 1.00, which is about one-third the average for that section; in the south Pacific coast region it exceeded the average slightly, and in the north Pacific coast region about 6.00 of rain fell, this amount being slightly below the normal.

## DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows for certain stations, as reported

by voluntary observers, (1) the average precipitation for a series of years; (2) the length of record during which the observations have been taken, and from which the average has been computed; (3) the total precipitation for November, 1887; (4) the departures of the current month from the average; (5) and the extreme monthly precipitation for November during the period of observations and the year of occurrence:

State and station.	County.	(1) Average for the month of Nov.	(2) Length of record.	(3) Total for November, 1887.	(4) Departure from average.	(5) Extreme monthly precipitation for November.			
						Greatest.		Least.	
						Am't.	Year.	Am't.	Year.
Arkansas.		Inches.	Years.	Inches.	Inches.	Inches.		Inches.	
Lead Hill.....	Boone.....	4.00	6	3.64	-0.34	5.77	1883	2.50	1885
California.									
Fall Brook.....	San Diego.....	1.47	11	1.03	-0.56	5.92	1885	0.00	1883
Sacramento.....	Sacramento.....	2.04	22	0.54	-1.50	9.65	1887	trace.	1884
Connecticut.									
Canton.....	Hartford.....	4.64	26	2.36	-2.28				
Hartford.....	Hartford.....	3.46	16	2.21	-1.25				
Middletown.....	Middlesex.....	3.87	29	2.37	-1.50				
Wallingford.....	New Haven.....	3.85	29	2.54	-1.31				
Dakota.									
Webster.....	Day.....	1.86	5	0.29	-1.57	4.33	1886	0.08	1883
Florida.									
Archer.....	Alachua.....	1.48	5	0.37	-1.11				
Illinois.									
Aledo.....	Mercer.....	3.90	10	1.00	-2.90				
Mattoon.....	Coles.....	3.98	8	6.84	+2.86				
Peoria.....	Peoria.....	2.31	32	1.62	-0.69				
Riley.....	McHenry.....	1.98	27	1.87	-0.11				
Sandwich.....	De Kalb.....	2.76	35	2.35	-0.41				
Indiana.									
Logansport.....	Cass.....	2.99	33	5.21	+2.22	6.30	1864	0.41	1865
Spiceland.....	Henry.....	2.97	27	3.22	+0.25				
Vevay.....	Switzerland.....	3.08	21	3.05	-0.03	5.73	1883	0.73	1872
Iowa.									
Cresco.....	Howard.....	1.37	14	1.03	-0.34				
Monticello.....	Jones.....	2.32	34	0.77	-1.55	5.29	1879	0.12	1866
Kansas.									
Wellington.....	Sunman.....	0.96	9	0.18	-0.78	1.85	1884	0.10	1886
Yates Centre.....	Woodson.....	1.71	7	0.39	-1.32	3.18	1881	0.39	1887
Louisiana.									
Grand Coteau.....	St. Landry.....	6.42	5	1.86	-4.56				

## Deviations from average precipitation—Continued.

State and station.	County.	(1) Average for the month of Nov.	(2) Length of record.	(3) Total for November, 1887.	(4) Deviation from average.	(5) Extreme monthly precipitation for November.			
						Greatest.		Least.	
						Am't.	Year.	Am't.	Year.
<b>Maine.</b>		<i>Inches</i>	<i>Years</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>		<i>Inches</i>	
Cornish	York	3.73	39	4.92	+1.19				
Gardiner	Kennebec	4.30	49	3.64	-0.66				
Lewiston	Androscoggin	4.82	13	5.09	+0.27				
Orono	Penobscot	4.48	19	3.48	-1.00				
<b>Maryland.</b>									
Cumberland	Alleghany	2.08	16	0.82	-1.26	5.10	1877	0.82	1882
Fallston	Harford	3.64	17	2.02	-1.62	10.27	1877	0.45	1887
<b>Massachusetts.</b>									
Amherst	Hampshire	3.80	53	3.54	-0.26				
Cambridge	Middlesex	3.90	47	2.87	-1.03				
Lake Cochituate	Middlesex	4.46	36	2.76	-1.70				
Lynn	Essex	4.09	13	3.09	-1.00				
Myatie Lake	Middlesex	3.88	12	2.04	-1.84				
New Bedford	Bristol	4.27	15	2.60	-1.67				
Somerset	Bristol	4.45	17	2.37	-2.08				
Springfield	Hampden	3.54	49	3.21	-0.33				
Waltham	Middlesex	4.00	63	2.87	-1.13				
Williamstown	Berkshire	2.88	20	3.77	+0.89				
<b>New Brunswick.</b>									
Saint Johns	Saint Johns	5.58	27	3.65	-1.93				
<b>New Hampshire.</b>									
Concord	Merrimac	3.52	32	3.70	+0.18				
Hanover	Grafton	2.53	21	2.98	+0.45				
<b>New Jersey.</b>									
Dover	Morris	3.71	5	1.58	-2.13				
<b>New York.</b>									
Boyd's Corners	Putnam	3.77	21	2.69	-1.08				
Factoryville	Tioga	2.04	6	2.17	+0.13	4.17	1886	0.91	1883
Humphrey	Cattaraugus	3.72	4	2.27	-1.45	6.23	1886	2.71	1885
Palermo	Oswego	3.87	34	3.25	-0.62	8.30	1863	0.30	1882
<b>Ohio.</b>									
Wauseon	Fulton	3.05	15	3.78	+0.73	5.83	1881	1.46	1884
<b>Pennsylvania.</b>									
Grampian Hills	Clearfield	2.85	17	2.28	-0.57				
Dyberry	Wayne	3.09	17	2.60	-0.49	7.10	1886	1.77	1872
<b>Rhode Island.</b>									
Providence	Providence	4.12	56	2.16	-1.96				
<b>South Carolina.</b>									
Stateburg	Sumter	1.89	7	0.93	-0.96	3.90	1882	0.87	1886
<b>Texas.</b>									
Corsicana	Navarro	3.50	3	5.62	+2.12				
New Ulm	Austin	5.10	16	0.48	-4.62	14.93	1873	0.48	1887
<b>Vermont.</b>									
Lunenburg	Essex	3.23	38	2.15	-1.08				
Stratford	Orange	3.60	13	3.70	+0.10			0.90	1882
<b>Virginia.</b>									
Bird's Nest	Northampton	2.22	19	1.80	-0.42				
Dale Enterprise	Rockingham	1.75	7	0.65	-1.10	6.46	1886	0.52	1882
Variety Mills	Nelson	2.18	8	1.02	-1.16	4.63	1880	0.59	1882
Wytheville	Wythe	2.71	23	0.44	-2.27			0.44	1887

The following notes on precipitation are furnished by the voluntary observers:

Lead Hill, Boone Co., Ark.: the precipitation of the autumn of 1887, 9.88, is 1.60 below the autumn average of the last six years; the greatest autumn precipitation, 25.40, occurred in 1883, and the least, 7.36, in 1885.

Logansport, Cass Co., Ind.: the total depth of snowfall for November, 1887, 5, is the same as the average of the past thirty-two years; the highest November snowfall in that period, 18, occurred in 1874, and the least, trace, in 1865. No snow fell during the month in 1860, 1861, and 1883.

Monticello, Jones Co., Iowa: the total depth of snowfall for November, 1887, 4, is 1 above the average of the last thirty-four years; the largest November snowfall in that time, 16, occurred in 1869.

Palermo, Oswego Co., N. Y.: the depth of snowfall for November, 1887, 16, is 9 above the average of the last thirty-four years; the largest November snowfall in that time, 39, occurred in 1880, and the least, 2, in 1877.

New Ulm, Austin Co., Tex.: the total precipitation of the autumn of 1887, 6.44, is 8.32 below the average of the last sixteen years.

Cumberland, Alleghany Co., Md.: the precipitation for the autumn months (September, October, and November) of 1887 is 4.89, or 1.77 below the average of the corresponding period of the past sixteen years.

Jeffersonville, Clark Co., Ind.: the precipitation for September, October, and November, 1887, 6.47, is 2.58 below the average of the corresponding period of the last five years.

Riley, McHenry Co., Ill.: the precipitation for the autumn of 1887, 9.23, is 0.78 above the normal of the corresponding period of the last twenty-six years.

## HAIL.

Hail fell at scattering stations, mostly in the Northern States and territories, during the month on the following dates: 1st, 8th to 12th, 14th, 17th, 19th, 20th, 23d to 28th, 30th.

## SLEET.

Sleet fell at scattering stations, mostly in the Northern States and territories, during the month on the following dates:

1st, 5th, 7th to 10th, 11th to 20th, 22d to 28th, 30th. It most frequently occurred from the 22d to the 28th.

## SNOW.

Snow fell in the Northern States and territories on numerous dates during the month. South of the thirty-fifth parallel snow was reported by but three stations, viz.: Whipple Barracks, Ariz., 25th; Willcox, Ariz., 26th, and Abilene, Tex., 27th. At Lincolnton, N. C. (Lat. 35° 29'), about half an inch of snow fell on the 2d, and light snow fell on the 8th.

## MONTHLY SNOWFALLS (in inches and tenths).

The following stations report monthly snowfalls of five inches or more; but in states having less, the maximum amount is also given:

**California:** Cisco, 16; Emigrant Gap and Summit, 15; Towles, 9; Halleck, 6. **Colorado:** Grand Junction, 5.5. **Connecticut:** North Colebrook, 4.3. **Dakota:** Richardton, 5.2; Deadwood, 5. **Illinois:** Lake Forest, 6; Aurora, 5.6; Riley, 5.5; Wheeling and Beason, 5. **Indiana:** Rushville, 11.8; Logansport, 6.8; Worthington, 6; Mauzy and Vevay, 5.5; Muncie, 5. **Iowa:** Cresco, 9.5; Independence, 6; Logan, 5. **Kansas:** Oberlin, 7; Kirwin, 5. **Kentucky:** Bowling Green, 4.8. **Maine:** Mayfield, 4.5. **Massachusetts:** Dudley, 5. **Michigan:** Calumet, 33.1; Marquette, 28.1; Sault Sainte Marie, 21.1; Central Mine, 21; Alpena, 13.7; Alma, 11.8; Mackinaw City, 10.9; Hillman and Gaylord, 10; Fletcher and Benzonia, 8.5; Harrisville, 7.5; Lansing (State Capitol) and Hastings, 7; Jonesville, Buchanan, and Greenville, 6.5; Traverse City, Ovid, Snowflake, and Saginaw, 6; Grand Rapids, 5.9; Mio, 5.8; Saint Johns and West Branch, 5.5; Escanaba, 5. **Minnesota:** Redwood Falls, 32; Minneapolis, 7.9. **Montana:** Fort Maginnis, 14.2. **Nebraska:** North Platte, 6.8; Genoa, 5. **New Hampshire:** Berlin Mills, 23; West Milan, 19; Stratford, 13; Shelburne, 12. **Nevada:** Beowawe, 5. **New York:** Utica, 17; Palermo, 16.2; Oswego and Cooperstown, 13; Worcester, 10.5; Friendship, 10; Le Roy, 9; Humphrey, 8.8; Buffalo, 8.3; Auburn, 8. **Ohio:** Kenton, 23.3; Jefferson, 12; Georgetown, 10; Yellow Springs, 9.6; Jacksonborough and Bangorville, 9; Clevelanda, 8.9; Tiffin, 8.5; Mansfield, Westerville, and Ohio State University, 8; Cleveland b, 7.5; North Lewisburg, Ruggles, Celina, and Hiram, 7; Garrettsville, 6.8; Wooster and McConnellsville, 6.5; Canton, Sidney, Clarksville, and Hanging Rock, 6; Dayton, 5.8; Oberlin, 5.3; Waverly, 5.2; New Athens, Greenville, and Akron, 5. **Pennsylvania:** Erie, 10; Meadville, 7; Grampian Hills, 5.5; Dyberry, 5. **Utah:** Kelton, 4. **Vermont:** Charlotte, 25; Northfield, 24.3; Stratford, 20; Burlington, Newport, and Chelsea, 19; Lunenburg, 14; Woodstock, 9; Manchester, 8.8. **West Virginia:** Middlebrook, 8. **Wisconsin:** Chippewa Falls, 30; Rhinelander, 16; Green Bay, 15.3; Fond du Lac, 11; Embarras, 10.5; Portage, 9; La Crosse, 7.7; Manitowoc, 7; Franklin and Phillips, 6; Delavan, 5.2; Lancaster, 5. **Wyoming:** Cheyenne, 3.

## DATES OF FIRST SNOWFALL WINTER OF 1887-1888.

The first snowfalls of the season reported from various selected stations in the country are as follows:

**Arizona:** Fort Apache, October 8th; Whipple Barracks, November 25th; Willcox, November 26th. **Arkansas:** Lead Hill, November 27th. **Colorado:** Denver, October 7th; Fort Lewis, October 8th. **Connecticut:** North Colebrook, October 12th; Voluntown, October 21st. **Dakota:** Deadwood, September 12th; Fort Buford, October 7th; Yankton, October 23d. **District of Columbia:** Washington City, November 11th. **Idaho:** Fort Sherman, October 26th. **Illinois:** Cairo, November 27th; Chicago, October 21st; Rockford, October 22d. **Indiana:** Jeffersonville, November 19th; Logansport, November 21st; Terre Haute, November 29th. **Indian Territory:** Fort Reno, October 24th; Fort Supply, November 23d. **Iowa:** Cresco, October 22d; Keokuk, October 29th; Monticello, October 22d. **Kansas:** Dodge City and Leavenworth, November 23d; Concordia, November 25th. **Kentucky:** Bowling Green, November 27th; Elkin, November 26th; Frankfort, November 19th. **Maine:**

Bar Harbor, October 12th; Eastport, November 5th; Orono, October 30th; Portland, November 11th. Maryland: Fallston, November 18th; New Midway, November 19th. Massachusetts: Boston, New Bedford, and Williamstown, November 11th. Michigan: Detroit, October 21st; Fort Brady and Marquette, October 11th; Minnesota: Duluth, October 20th; Saint Paul, October 22d; Saint Vincent, October 10th. Missouri: Conception and Lamar, November 26th; Saint Louis, November 27th. Montana: Fort Assinaboine and Fort Custer, October 7th; Helena, October 6th. Nebraska: North Platte, October 24th; Omaha, October 23d; Valentine, October 22d. Nevada: Fort McDermitt, November 15th; Winnemucca, October 7th. New Hampshire: Berlin Mills and Nashua, November 11th; Wolfborough, November 10th. New Jersey: Dover and Egg Harbor City, November 11th; New Brunswick, October 25th. New Mexico: Fort Wingate, November 23d; Gallinas Spring, November 22d; Santa Fé, November 26th. New York: Buffalo, October 29th; New York City, November 11th; Plattsburg Barracks, November 10th. North Carolina: Charlotte, October 31st; Lincolnton, November 2d; Raleigh, October 31st. Ohio: Cleveland, Sandusky, and Toledo, October 21st. Oregon: Fort Klamath, October 6th; Portland, November 24th. Pennsylvania: Erie, October 21st; Philadelphia, November 11th; Pittsburg, October 21st. Rhode Island: Block Island, November 11th. Tennessee: Ashwood and Milan, November 27th; Chattanooga, October 30th. Texas: Abilene, November 27th; Fort Elliott, November 23d. Utah: Frisco, October 6th; Salt Lake City, November 17th. Vermont: Newport, November 10th; Northfield, October 22d. Virginia: Dale Enterprise, November 11th; Marion, November 19th. Washington Territory: Spokane Falls and Walla Walla, November 24th. Wisconsin: Delavan and Milwaukee, October 21st; Embarras, October 23d. Wyoming: Cheyenne, September 12th; Fort Bridger, October 6th.

#### DEPTH OF UNMELTED SNOW ON GROUND AT END OF MONTH.

[Expressed in inches and tenths.]

California: Fort Bidwell, 3. Colorado: Grand Junction, 3; Las Animas, 1; Colorado Springs, 0.2. Dakota: Parkston, 4; Richardton, 3; Fort Buford, 2; Deadwood and Fort Sully, 1; Yankton, 0.7; Fort Totten, 0.5; Bismarck, 0.2. Illinois: Belvidere, 2; Lake Forest, 1; Aurora and Cairo, 0.5; Chicago, Oswego, Riley, Springfield, Albion, Jacksonville, McLeansborough, and Wheeling, trace. Indiana: Butlerville, Sunman, and Vevay, 2; Indianapolis, 0.6. Iowa: Dubuque, 4.5; Cedar Rapids, 2.5; Independence, 2 to 4; Cedar Rapids, 1.5; Oskaloosa, 1.2; Albia, 1; Oskaloosa, drifts; Bancroft, Clinton, and Des Moines, trace. Kansas: Concordia, 2; East Norway, 0.5 to 2; West Leavenworth, 0.5; Wakefield, trace. Kentucky: Elkin, 3; Lexington, 1.4; Louisville, 0.2. Massachusetts: Williamstown, 1. Michigan: Central Mine, 21; Calumet, 16; Sault Sainte Marie, 14; Marquette, 10; Benzonia, 7; Gaylord, 6; Snowflake, 3.5; Escanaba and West Branch, 3; Fletcher, 2.5; Mackinaw City and Traverse City, 2; Greenville, 0.5; Alpena, 0.1; Grand Haven, trace. Minnesota: Minneapolis, 7; Saint Paul, 3; Saint Vincent, 2; Moorhead, 0.8. Montana: Fort Assinaboine, 4; Poplar River, 1.6; Helena, 1; Fort Maginnis, 0.5. Nebraska: Valentine, 2.6; Genoa and Hay Springs, 2; Kimball, North Platte, and Omaha, 1; De Soto, 0.2; Crete, trace. New York: Oswego, 4.5; Utica, 2.2; Auburn, Cooperstown, and Humphrey, 2; Ithaca, 1; Albany, Buffalo, and Menands, trace. Ohio: Cleveland, 6; Cleveland, Ruggles, and Yellow Springs, 4; Jacksonburg, Portsmouth, and Westerville, 3; Tiffin, 2.5; College Hill, Garrettsville, and Sandusky, 2; Cincinnati and Columbus, 1; New Athens, 0.5. Pennsylvania: Erie, 3; Wellsborough, trace. Utah: Frisco, 1. Vermont: Lunenburg and Northfield, 2; Manchester and Strafford, 1. Washington Territory: Spokane Falls, 0.7. West Virginia: Middlebrook, trace. Wisconsin: Embarras, 6; Fond du Lac and Green Bay, 5; Madison, 3; La Crosse and Prairie du Chien, 2; Manitowoc, 1.5. Wyoming: Fort Bridger, 0.4.

#### Excessive precipitation for the month of November, 1887.

States and stations.	Monthly, 6 inches, or more.	Specially heavy.					
		2 inches, or more, per day.			At rate of inch, or more, per hour.		
		Am't.	Dura- tion.	Date.	Am't.	Dura- tion.	Date.
<i>Arkansas.</i>			<i>h. m.</i>			<i>h. m.</i>	
Little Rock	2.05		24 00	23, 24			
<i>British Columbia.</i>							
New Westminster	9.02	2.29		9			
Do.	2.13			13			
<i>Illinois.</i>							
Vandalia	8.95	5.00		26			
Pana.	7.58	3.25		26			
Irishtown	7.45	2.63		27			
Jordan's Grove	7.09	3.25		27			
Charleston	7.06	5.21	32 00	26, 27			
Mattoon	6.84	5.11		26			
Paris	6.47	2.00		26			
Greenville	6.38	3.40		26			
Maacoutah	6.34						
New Athens	6.25						
Windsor		2.73		26			
Flora		2.29		26			
<i>Indiana.</i>							
Marengo	6.00						
Rockville		2.40		?			
Logansport		2.20		27			
<i>Louisiana.</i>							
Shreveport		2.90	24 00	24, 25			
<i>Michigan.</i>							
Central Mine	6.36				1.02	1 00	27
Mottville							
<i>Mississippi.</i>							
Biloxi		3.25	4 00	9			
<i>Missouri.</i>							
Forest Park		2.04		26			
Saint Louis		2.32	24 00	26			
<i>Ohio.</i>							
New Bremen		2.10		26			
<i>Oregon.</i>							
Astoria	8.11	2.26		8, 9			
Bandon	6.57	2.41		28, 29			
Yaquina L. H.	6.06	2.63		8			
Astoria		2.26		8, 9			
<i>Texas.</i>							
Corsicana		3.62	32 30	23, 24, 25			
Do.		2.00	2 00	26	2.00	2 00	26
<i>Virginia.</i>							
Cape Henry		2.15		10, 11			
<i>Washington Territory.</i>							
Tatoosh Island	10.15						
Fort Canby	7.25						

\*Less than 19 hours.

Table showing the occurrence in the month of November of monthly precipitation of 10 inches, or more; precipitation equaling or exceeding 2.50 inches in 24 hours; and rains of one inch, or more, in one hour.

States and stations.	Rainfall of 10 inches, or more, per month.		Rainfall of 2.50 inches, or more, in 24 hours.		Rainfall equaling or exceeding one inch per hour.			
	Year.	Amt.	Day.	Year.	Amt.	Day.	Year.	Time
		Inches			Inches			h. m. Inches
<i>Alabama.</i>								
Livingston	1880	10.54						
Mobile			8	1872	3.11			
Do.			16	1876	2.53			
Do.			20	1877	2.50			
Do.			25	1878	3.40			
Do.			6	1881	4.50			
Montgomery			8	1873	2.97			
Do.			26	1878	2.65			
<i>Arkansas.</i>								
Fort Smith			9-10	1883	2.56			
<i>California.</i>								
Red Bluff	1885	17.05	3	1882	2.88			
Sacramento	1885	11.34	17	1885	4.29			
San Francisco	1885	11.78	22-23	1874	2.84			
Do.			23	1874	3.98			
Do.			23-24	1874	3.08			
Do.			24	1885	2.58			
San Luis Obispo	1885	12.90						
<i>Connecticut.</i>								
New Haven			10	1875	2.93			
New London			6-7	1872	3.70			
<i>Florida.</i>								
Jacksonville			27-28	1884	3.75			
Key West			4	1884	3.51			
Pensacola	1885	11.07	6	1881	3.54			
Do.			23	1884	3.21			
Do.			6	1885	2.69			
<i>Georgia.</i>								
Atlanta			26-27	1878	2.65			
Augusta			6-7	1873	2.64			
Ellerslie	1880	12.60						
<i>Illinois.</i>								
Cairo			21-22	1874	2.52			
Do.			22-23	1875	2.74			
Chicago			11-12	1881	3.38			
Do.			5-6	1883	3.39			
Peoria			26	1858	3.40			

Table showing the occurrence, &amp;c.—Continued.

States and stations.	Rainfall of 10 inches, or more, per month.		Rainfall of 2.50 inches, or more, in 24 hours.		Rainfall equaling or exceeding one inch per hour.			
	Year.	Amt.	Day.	Year.	Amt.	Day.	Year.	Time
<i>Indiana.</i>		<i>Inches.</i>			<i>Inches.</i>			<i>h. m.</i>
Indianapolis.....			18	1881	4.30	18	1881	1 00
Do.....			21	1883	3.71	21	1883	1 00
<i>Iowa.</i>								
Des Moines.....			11-12	1879	2.84			
Onawa.....			17	1886	4.50			
<i>Kansas.</i>								
Leavenworth.....			1	1876	2.81			
Do.....			8	1879	2.56			
Do.....			11	1879	2.58			
Do.....			11	1881	3.10			
<i>Louisiana.</i>								
New Orleans.....			12-13	1871	2.80			
Do.....			4-5	1873	2.61			
Do.....			2	1876	2.61			
Do.....			6	1881	2.99			
Point Pleasant.....	1877	20.89						
Do.....	1880	19.52						
Shreveport.....			22	1873	4.00			
Do.....			8	1881	2.50			
Do.....			10	1883	4.83			
Do.....			23	1887	2.90			
<i>Maine.</i>								
Portland.....			15-16	1871	2.69			
Do.....			24-25	1871	2.70			
Do.....			26-27	1883	2.65			
Baltimore, Maryland.			24	1877	2.85			
<i>Massachusetts.</i>								
Boston.....	1876	11.03	15	1871	3.00			
Do.....			17-18	1873	3.45			
Do.....			20-21	1876	5.43			
Do.....			25-26	1877	2.93			
Do.....			18	1878	3.09			
Wood's Holl.....	1876	11.70						
<i>Mississippi.</i>								
Starkville.....			27	1882	2.55			
Vicksburg.....	1880	14.15	1	1877	2.50	28	1879	1.20
Do.....	1883	11.53	7-8	1877	2.83			
Do.....			24-25	1880	3.18			
Do.....			28	1880	2.93			
Do.....			11	1881	3.32			
Do.....			10-11	1883	4.79			
Do.....			22	1883	4.02			
<i>Missouri.</i>								
Saint Louis.....			17-18	1881	2.99			
<i>New Hampshire.</i>								
Mount Washington.....	1877	17.55	23-24	1884	3.30			
Do.....	1881	15.10						
<i>New York.</i>								
Buffalo.....			14-15	1871	2.53			
New York City.....			6-7	1872	2.83			
<i>North Carolina.</i>								
Hatteras.....	1880	12.68						
Do.....	1884	13.02	15	1880	3.10	24	1877	1 00
Do.....			28	1882	2.99			
Do.....			26	1883	3.12			
Do.....			16	1884	3.80			
Do.....			28	1882	2.87			
Kitty Hawk.....			16	1884	4.04			
Do.....			1	1887	4.52			
Raleigh.....						28	1877	1 00
Statesville.....								1.20
<i>Ohio.</i>								
Columbus.....			18-19	1881	2.95			
Toledo.....			13-14	1871	2.68			
<i>Oregon.</i>								
Astoria.....	1885	12.45						
Bandon.....	1885	18.21						
Eola.....	1877	13.01						
Portland.....	1874	10.22	27	1883	3.62			
Do.....	1876	15.77						
Do.....	1876	10.03						
Do.....	1877	12.45						
Roseburg.....			6-7	1885	3.58			
<i>Pennsylvania.</i>								
Philadelphia.....			19-20	1876	2.59			
<i>South Carolina.</i>								
Charleston.....			8	1877	4.17			
Do.....			18-19	1879	3.58			
<i>Tennessee.</i>								
Chattanooga.....			22	1883	3.00			
Knoxville.....			16-17	1873	2.55	30	1880	0 55
Do.....			22-23	1874	2.54			
Do.....			25-26	1878	2.79			
Do.....			22-23	1883	2.65			
Do.....			6-7	1885	3.14			
<i>Texas.</i>								
Brownsville.....			13	1882	2.60	2	1873	0 30
Galveston.....			12-13	1871	2.67	5	1877	0 15
Do.....			6	1872	5.63			
Do.....			19	1877	2.53			
Do.....			22	1884	2.51			
New Ulm.....	1873	14.93						
Palestine.....			25-26	1882	2.95	10	1883	0 50
Do.....			10	1883	5.05			
Do.....			3-4	1885	2.51			
San Antonio.....						27	1887	1 00
Lynchburg, Virginia.			22	1877	4.23			
<i>Washington.</i>								
Canby, Fort.....	1885	13.72						
Neah Bay.....	1885	19.60						
Olympia.....	1877	19.88	15-16	1878	3.24			
Do.....	1878	11.09						
Do.....	1885	10.18						
Pyshat.....	1885	13.07						
Tatoosh Island.....	1885	19.25	27-28	1883	4.49			
Do.....	1886	10.44						

## HEAVY RAINFALLS AT WASHINGTON CITY.

In connection with a request from the superintendent of sewers for certain information regarding rainfall in Washington City, a considerable amount of data has been gathered, a partial discussion of which may be of interest to engineers throughout the country. The observations cover a period of seventeen years (less one month), from January, 1871, to November 30, 1887; in which time rain or melted snow has been recorded 1,543 times. The rainfall has exceeded one inch one hundred and ninety-two times, or almost exactly once in eight times. On thirty-seven different occasions (about 2½ per cent.) the amount of rain during the storm has equaled or exceeded two inches. Rainfalls exceeding two inches occurred four times in August, and six times each in June, July, September, and October; while they were rare in other months; none at all having been observed in February. The heaviest rainfall from a single storm was 5.80 inches in nineteen hours on July 29th and 30th, 1878.

Of equal and perhaps greater importance than the amount recorded during a single storm, is the rate which falls in any single hour. Assuming that a less rate than one inch per hour is not especially important, examination was confined to those cases in which the rate was greater. Sixteen cases have occurred, as shown in the table below:

Heaviest falls of rain at Washington City, from January, 1871, to November, 1887, inclusive.

Date.	Amount.	Time.	Rate of fall.	
			Per hour.	Maximum at any time.
	<i>Inches.</i>	<i>h. m.</i>	<i>Inches.</i>	<i>Inches.</i>
July 3, 1871.....	1.13	0 30	2.26	2.26
July 18, 1871.....	0.83	0 20	2.49	2.49
September 25, 1872.....	1.50	1 00	1.50	8.00
August 18, 1875.....	1.20	1 00	1.20	2.40
August 29, 1875.....	1.30	1 00	1.30	1.30
October 23, 1875.....	1.40	1 00	1.40	2.50
June 22, 1877.....	1.08	1 00	1.08	2.00
July 28, 1877.....	1.20	1 00	1.20	3.00
July 29, 1877.....	1.42	0 26	3.24	3.24
October 4, 1877.....	1.49	1 00	1.49	6.00
July 2, 1884.....	1.12	1 00	1.12	3.00
November 24, 1884.....	1.00	1 00	1.00	2.00
July 26, 1885.....	0.96	0 06	9.60	9.60
October 29, 1885.....	1.20	1 00	1.20	2.40
June 24, 1886.....	1.10	1 00	1.10	3.00
July 26, 1886.....	1.80	1 00	1.80	6.00

Thus it appears that on two occasions, September 25, 1872, and October 4, 1877, 1.50 inches fell in one hour.

Perhaps, however, the more important and destructive results followed from the storm on July 26, 1886, when a rainfall of 1.80 inches occurred in one hour.

An examination of the records of the self-registering rain gauge proved that the rate of rainfall for short periods of time far exceeds the rate per hour. As, for instance, on October 4, 1877, and July 26, 1886, the rate equaled six inches per hour, and on September 25, 1872, eight inches per hour. The maximum rate recorded, however, was the extraordinary one of 9.60 per hour, which occurred on July 26, 1885, when .96 inch of rain fell in six minutes.

It is possible that these data may be of marked value to engineers in showing that the occasions are very rare in Washington, and probably in adjacent cities, when more than an inch and a quarter of rain may be expected within an hour.

## DROUGHT.

In addition to the data given in previous REVIEWS concerning the protracted drought of 1887, the following table has been prepared, showing the normal precipitation for the period from March 1st to November 30th, also that for the corresponding period of the current year, with the departures, etc., at certain Signal Service stations in the region most seriously affected by the drought:

Precipitation from March to November—Signal Service observations.

Stations.	Normal.	Total. for 1887.	Comparison of 1887 with the normal.	Percentage of normal rainfall for the months.
	Inches.	Inches.	Inches.	Per cent.
Atlanta, Ga.	39.8	37.4	-2.4	94
Cairo, Ill.	33.2	15.1	-18.1	45
Chattanooga, Tenn.	41.0	32.9	-8.1	80
Chicago, Ill.	30.3	17.2	-13.1	57
Cincinnati, Ohio	31.3	23.6	-7.7	75
Cleveland, Ohio	29.7	23.5	-6.2	79
Columbus, Ohio	32.1	19.5	-12.6	61
Des Moines, Iowa	33.7	20.7	-13.0	61
Detroit, Mich.	26.7	21.1	-5.6	79
Dubuque, Iowa	33.3	24.3	-9.0	73
Escanaba, Mich.	30.1	16.6	-13.5	55
Fort Smith, Ark.	30.4	29.2	-1.2	93
Galveston, Tex.	41.2	30.0	-11.2	73
Grand Haven, Mich.	30.4	20.0	-10.4	66
Indianapolis, Ind.	35.3	22.5	-12.8	64
Keokuk, Iowa	31.5	17.0	-14.5	54
Knoxville, Tenn.	39.0	28.8	-10.2	74
La Crosse, Wis.	28.4	14.5	-13.9	51
Leavenworth, Kans.	34.0	31.3	-2.7	92
Little Rock, Ark.	38.2	22.7	-15.5	59
Louisville, Ky.	34.9	23.4	-11.5	67
Memphis, Tenn.	39.5	23.3	-16.2	59
Milwaukee, Wis.	17.6	19.8	+2.2	111
Mobile, Ala.	50.2	35.1	-15.1	70
Montgomery, Ala.	38.4	23.9	-14.5	62
Nashville, Tenn.	37.0	29.5	-7.5	80
New Orleans, La.	49.0	47.5	-1.5	97
Omaha, Neb.	33.3	17.2	-16.1	52
Pensacola, Fla.	50.3	38.2	-12.1	76
Pittsburg, Pa.	27.8	31.6	+3.8	114
Port Huron, Mich.	26.7	15.7	-11.0	59
Saint Louis, Mo.	33.0	27.4	-5.6	83
Saint Paul, Minn.	25.6	21.7	-3.9	85
Sandusky, Ohio	29.5	17.9	-11.6	61
Shreveport, La.	38.9	28.8	-10.1	77
Springfield, Ill.	32.5	16.0	-16.5	49
Toledo, Ohio	26.2	20.2	-6.0	77
Vicksburg, Miss.	43.2	27.5	-15.7	64
Yankton, Dak.	26.6	24.0	-2.6	90

A chart based upon data contained in the above table shows that over nearly the whole region extending from the Great Lakes to the Gulf between the eighty-second and ninety-fifth meridians the rainfall during the period from March 1 to November 30, 1887, did not exceed 80 per cent. of the normal, except over a small area at the mouth of the Mississippi. Over a large portion of the region named the percentage of precipitation falls to 60, and over a considerable area in southern Illinois only about 50 per cent. of the normal precipitation fell during the period mentioned.

The following notes on drought during November and preceding months have been received:

Little Rock, Ark., 4th: rain is badly needed in all sections of the state; wells are becoming dry and cattle suffering for water.

Paris, Monroe Co., Mo., 9th: light rain, the first for several weeks, during the night of the 8-9th; streams are nearly dry and water is very scarce. Typhoid fever prevailing in this section is attributed to the use of impure water.

Marshall, Saline Co., Mo.: the heavy rain on the 9th was greatly needed throughout this county. Ponds were nearly dry, and stock suffered for water.

Carbondale, Jackson Co., Ill.: the rain of the 9th was of great benefit as it broke the drought and put out the forest fires which had been burning in this and adjoining counties for several days.

Centralia, Marion Co., Ill.: the protracted drought in this vicinity was broken by the rain of the 9th; the scarcity of water caused much inconvenience.

Nashville, Tenn., 18th: severe drought is prevailing over the entire state; only 0.45 inch of rain has fallen at this station since October 25th.

The observer at Sunman, Ripley Co., Ind., reports: "The rains from the 22d to the 27th terminated the severest drought of the last fifty years."

Charleston, Coles Co., Ill.: on the 22d the creeks were all dry, cisterns and wells nearly exhausted, and cattle suffering for water; on this date rain began and continued until the 27th; during the last two days of the storm 5.21 inches of rain fell.

Milan, Gibson Co., Tenn.: the protracted drought was broken on the 23d; streams and wells had dried up, and water had to be hauled long distances.

Laconia, Harrison Co., Ind.: the rain of the 23d replenished cisterns, ponds, etc. The Ohio River at this place was lower than known for past forty years.

Rev. T. H. Sonnedecker, Tiffin, Ohio, reports as follows: "The long and memorable drought was broken by the rains from the 24th to 27th. A special feature of the drought of November, 1887, is that old settlers say that it was the most severe of any in their recollection. Wheat has suffered severely; many wells which were never dry before and cisterns which were never empty failed, so that farmers were obliged to dig their wells much deeper or drive their stock three to five miles for water. A water train loaded at the Baltimore and Ohio Railroad well connecting with the Sandusky River was run from this city to different points, almost daily, to supply engines, or for household use."

Mottville, Saint Joseph Co., Mich.: the drought was partly relieved by the rains from the 24th to the 27th; winter wheat has been greatly retarded.

Wauseon, Fulton Co., Ohio: the long and disastrous drought was broken by the rains from the 24th to the 27th.

The Saint Louis, Mo., "Post-Dispatch" of the 24th contained the following:

"CHESTER, ILL., November 24.—Reports from all sections of the state show that refreshing rains fell throughout yesterday, notably at Mt. Vernon, Ramsey, Greenville, Centralia, Vandalia, Marion, Fairfield, Murphysborough, McLeansborough, Hillsborough, Marshall, and Duquoin.

"ELGIN, Ill., November 24.—The entire season of 1887 throughout the dairy district of this portion of Illinois has been unfavorable not only regarding dairy, but general farming. The fall of rain was light and winter set in without the usual fall rains, consequently, in many instances, there is a scarcity of water for stock. Again, owing to the drought, all kinds of grain were a light crop, and hay a complete failure. Farmers have to buy more or less grain for their dairy cattle each year, but this season many have to buy all their feed. There is no suffering of stock for lack of water.

"PIEDMONT, Mo., November 24.—A fine rain fell last night, with about two inches by the water-gauge.

"HERMANN, Mo., November 24.—The drought has affected the growing wheat very injuriously. Last Saturday we had a northern blizzard, very cold, and the wind traveling at a fearful velocity, which was more detrimental to the wheat than the drought. Stock water, and with many families water for ordinary and other purposes, had to be hauled from the river or some creek and has caused the farmers great inconvenience. The drought has so completely withered and dried up the grass and the deposit of leaves from the trees has been so heavy that forest fires have prevailed and inflicted great damage. Tuesday night there was a gentle rain, and last evening there was a slight fall, which is very grateful to vegetation and elates the hearts of the farmers. Wheat has been so damaged that only the most favorable weather from this to harvest will insure near a full crop."

Carmi, White Co., Ill.: the rain of the 26th ended the protracted drought and extinguished the forest fires which had been burning in this vicinity.

Windsor, Shelby Co., Ill., 27th: the drought which has prevailed during the past two months has been broken by three days' rain.

Cairo, Ill., 28th: the late rains have broken the drought in this vicinity, which had become very severe. Over a large area there has been little or no rain since the beginning of July. The rivers have continued at a low stage longer than ever known since any systematic gauging of the western rivers was begun. The Ohio River is so low that navigation, except for the smallest of boats (which are ordinarily used on the small tributaries), is practically suspended. The crops were below the average and the supply of water scant, the bad condition of the latter causing much sickness.

Livingston, Sumter Co., Ala.: November has been one of the driest months on record here, the total precipitation, 0.35 inch, fell on one day, the 28th.

Middlebrook, Randolph Co., W. Va., 30th: the drought continues, though somewhat relieved by the November rains. The mills are still without water.

Dale Enterprise, Rockingham Co., Va., 30th: the effect of the drought has been severely felt in the lack of water for stock; the streams are very low.

Elk Falls, Elk Co., Kans., 30th: the month has been very dry and water is scarce, the main supply has to be hauled from Elk River.

Mr. Wm. Dozier, Mattoon, Coles Co., Ill., reports as follows:

"MATTOON, ILL., December 10, 1887.—From June 1st to November 28d—175 days—we had 145 dry days and only 9½ inches of rain, during the 175 days. We had on the 4th and 11th of August 2½ inches of rain, and 2½ inches the last week in September, therefore having only 4½ inches in all the rest of the period of 175 days. The 4½ inches of rain occurred on 30 different days strung along the 175 days in showers of only a few drops, and at no time over ½ inch; and at no period of the 175 days were there more than two weeks without rain at all. The temperature in the shade by standard thermometers (the kind used by the United States Signal Service) during the summer season of 1887 was above 100° on 17 different days, and above 90° on 59 different days. The highest being 108°, on July 29th and 30th (highest in the sun, 124°). The season was only about 18 per cent. cloudy. The excessive heat and much sunshine a large portion of the 175 days would dry up a quarter or half inch shower in a few hours and the few drop showers almost instantly. Such a heated season would require about 7 inches more rain than other seasons, whereas we had only one-fourth the rainfall required to make a good crop season. The rainfall during one-half of the 11 days immediately following November 28d was nearly equal to that of the 175 days—being 8½ inches (5 inches on November 26th)."

Mr. John S. Seely, of Oswego, Kendall Co., Ill., in a communication to the Chief Signal Officer, dated December 19, 1887, reports as follows:

"It is easy to see why our crops have been poor this year; to date we have had but 26.16 inches of rainfall; in January and February we had 7.27 inches, which all ran off because the ground was frozen; from March to July, inclusive, 5.56 inches was all we had to do grain and hay crops any good; what we had in August and September, 6.18 inches, helped the fall feed and winter grain, but the ground was so parched that it made but little growth in comparison to what it would have done had the ground been in fair condition. The rains since October have been of but little benefit for this year. The weather has been so mild that the rain we have had has gone into the ground and will help next year, but we had not near enough. Water is still scarce. Records show that the rainfall has gradually diminished since 1882. The showers this season appeared to go around us; at Aurora, six miles north, more rain fell than at this place, and the same may be said of other localities, but none had a surplus."



Mr. B. F. Ferris, Sunman, Ind., reports as follows: "The severity of the drought was not altogether due to the deficiency of the rainfall, but was in a great measure intensified by the action of two other causes operating in conjunction with that. These were the high temperature of the three summer months and the unusual light character of the rains throughout the year. Upon comparing this with other years during which we have been taking daily observations for the Signal Service, we find that although the rainfall was con-

siderably less than that of 1885 and 1886 (3.15 and 5.70 inches, respectively), it was 5.55 more than that of 1884. The mean temperature of the summer of 1887 was 77°.1, 4° higher than 1885 and 1886, and 1°.8 higher than 1884. The rains of the current year have all been very light, so that but very little of it penetrated to any considerable depth but was confined to the surface, and was evaporated by the intense heat. At no time during the summer was the soil saturated so as to prevent ploughing immediately after rain had ceased."

## WINDS.

The most frequent directions of the wind during November, 1887, are shown on chart ii, by arrows flying with the wind. Over the northern districts east of the Rocky Mountains the prevailing winds were generally from west and northwest; in the lower Ohio and central Mississippi valleys, southerly; in other districts, variable.

## HIGH WINDS (in miles per hour).

The maximum velocities of wind for November, 1887, at Signal Service stations where the movements are registered, are given in the table of miscellaneous meteorological data. Other than the maximum velocities given in this table, but two stations report velocities of 50 or more miles per hour, viz.: Fort Canby, Wash., 60, s., 8th; 60, s., 9th; 60, s., 10th; 60, s., 12th; 68, s., 13th; 54, s., 27th; Valentine, Nebr., 50, n.w., 19th.

## LOCAL STORMS.

Cairo, Ill.: a thunder-storm, with high westerly winds, began 4.05 and ended 6.35 p. m. on the 9th; at 4.30 an unusual electrical phenomenon occurred in the form of a ball of lightning, which exploded with a terrific report when in altitude 40° in the northeast quadrant.

Butlerville, Jennings Co., Ind.: a severe wind storm set in at 9.15 a. m. on the 19th; at 10.40 a. m. it became so dark

that ordinary work could not be carried on without artificial light; the darkness cleared away at 12.30 p. m.

Fort Custer, Mont.: a severe wind storm prevailed from 2.45 until 6.40 p. m. on the 12th; maximum velocity, sixty miles per hour from the northwest, was recorded at 4.15 p. m.

Vevay, Switzerland Co., Ind.: a fierce gale from west began 10 a. m. of the 19th, scattering every movable object before it; the rough and turbulent condition of the Ohio River rendered its crossing and navigation in general impossible; the dark and gloomy atmosphere enveloped everything in darkness, and common print could not be distinguished; the gale continued throughout the day and the following night.

Key West, Fla.: the severe wind storm which began on the afternoon of the 20th attained its maximum velocity, thirty-six miles per hour, at 6.05 a. m. on the following date and ended 7.48 a. m.

Duquoin, Perry Co., Ill.: an unusually severe storm, for this season of the year, occurred during the night of the 26-27th; it was accompanied by loud thunder and vivid lightning.

Galveston, Tex., 28th: a report from Mineola, Wood Co., Tex., states that during the night of the 26-27th a severe storm occurred at that place. One building was blown down and several persons were killed.

## INLAND NAVIGATION.

## STAGE OF WATER IN RIVERS AND HARBORS.

In the following table are shown the danger-points at the various stations and the highest and lowest depths for November, with the dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, November, 1887 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, La. ....	29.9		11.5	24	3.4	8.1
<i>Arkansas River:</i>						
Fort Smith, Ark. ....	22.0	29	1.8	22, 23, 24	0.8	1.0
Little Rock, Ark. ....	23.0	1	2.0	21, 22, 23	1.1	0.9
<i>Missouri River:</i>						
Omaha, Nebr. ....	18.0	1, 2, 4, 5, 10, 11	5.7	22	5.3	0.4
Leavenworth, Kans. ....	20.0	13, 14	7.1	30	3.9	3.2
<i>Mississippi River:</i>						
Saint Paul, Minn. ....	14.5	14	1.9	22, 23	0.8	1.1
La Crosse, Wis. ....	24.0	1-9	3.0	27	2.1	0.9
Dubuque, Iowa ....	16.0	1	3.1	30	1.9	1.2
Davenport, Iowa ....	15.0					
Keokuk, Iowa ....	14.0	1	1.9	29	0.5	2.4
Saint Louis, Mo. ....	32.0	1	5.6	30	4.4	1.2
Cairo, Ill. ....	40.0	4.5	3.5	19, 20	2.1	1.4
Memphis, Tenn. ....	34.0	6, 7, 8, 9	3.2	18-23	2.2	1.0
Vicksburg, Miss. ....	41.0	1	2.0	24, 25	3.9	1.9
New Orleans, La. ....	13.0	9	3.0	17	1.3	1.7
<i>Ohio River:</i>						
Pittsburg, Pa. ....	22.0	29	6.7	25	5.1	1.6
Cincinnati, Ohio ....	50.0	28	5.1	21-24	2.8	2.3
Louisville, Ky. ....	25.0	30	3.3	6, 7	2.3	1.0
<i>Cumberland River:</i>						
Nashville, Tenn. ....	40.0	30	0.6	23, 24	0.2	0.8
<i>Tennessee River:</i>						
Chattanooga, Tenn. ....	33.0	1	3.0	25, 26, 27	1.4	1.6
<i>Monongahela River:</i>						
Pittsburg, Pa. ....	29.0	29	6.7	25	5.1	1.6
<i>Savannah River:</i>						
Augusta, Ga. ....	32.0	1	8.0	20, 29, 30	6.1	1.9
<i>Sacramento River:</i>						
Red Bluff, Cal. ....		13	0.9	4, 17-21, 24, 28	0.5	0.4
Sacramento, Cal. ....		15-25	7.6	1-12	7.2	0.4
<i>Willamette River:</i>						
Portland, Oregon ....		16	4.4	27	0.6	3.8

\* 27 days; river frozen after 27th.

## ICE IN RIVERS AND HARBORS.

*Mississippi River.*—Saint Paul, Minn.: an ice-dam formed in the river at this point on the 28th.

La Crosse, Wis.: the river was full of floating ice on the 20th and 23d. The last boat of the season arrived on the 25th; the river froze over on the 28th.

Dubuque, Iowa: the last boat of the season arrived on the 9th; navigation closed after that date. The river froze over on the 28th.

Keokuk, Iowa: the navigation closed on the 21st, steamers "Natrona" and "Dexter" being the last boats of the season.

*Missouri River.*—Fort Buford, Dak.: navigation closed on the 10th and the river froze over on the 24th.

Fort Yates, Dak.: the river froze over on the 27th.

Omaha, Nebr.: the river froze over on the 20th.

Leavenworth, Kans.: the river was full of floating ice during the 26th.

*Grand River.*—Lansing, Mich.: the river froze over on the 20th; ice broke on the 24th; river froze over again on the 28th.

*Thunder Bay River.*—Alpena, Mich.: the river froze over on the 30th.

*Devil's Lake.*—Fort Totten, Dak.: navigation closed on the 18th; the steamer "Minnie H." made her last trip of the season on this date; the lake froze over on the 22d.

*Laramie and Platte Rivers.*—Fort Laramie, Wyo.: these rivers froze over on the 26th.

*Fox River and Green Bay.*—Green Bay, Wis.: the river froze over on the 24th; Green Bay froze over on the 25th; steamer "De Pere" from Chicago was unable to reach port on this date on account of ice and was compelled to put back.

*Hudson River.*—Albany, N. Y.: there was floating ice in the river on the 22d.

*Rock River.*—Beloit, Rock Co., Wis.: the river froze over on the 28th.